

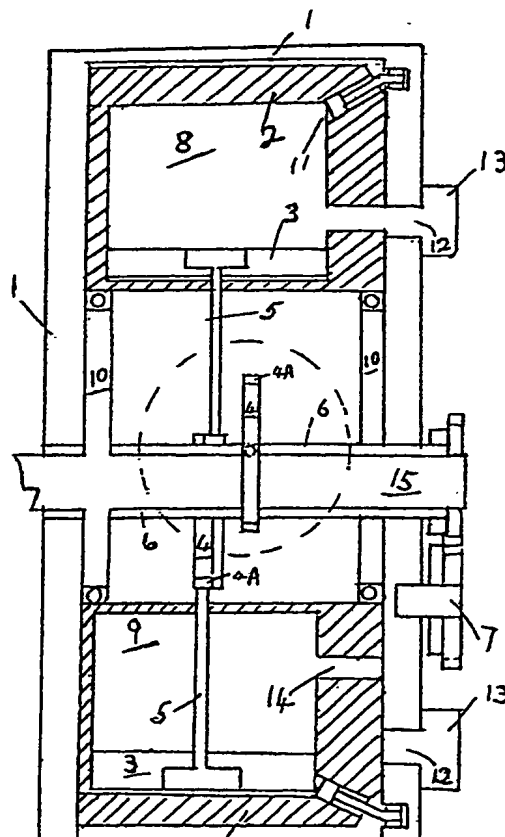


INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<p>(21) International Application Number: PCT/AU85/00275</p> <p>(22) International Filing Date: 12 November 1985 (12.11.85)</p> <p>(71)(72) Applicant and Inventor: RUSSELL, Sidney, Hugh [GB/AU]; Box 1127, Mareeba Post Office, Far North, QLD 4880 (AU).</p> <p>(81) Designated States: AT (European patent), AU, BE (European patent), CH (European patent), DE (European patent), FR (European patent), GB (European patent), IT (European patent), JP, LU (European patent), NL (European patent), SE (European patent), US.</p> <p>Published <i>With international search report.</i> <i>With amended claims.</i></p>		

(54) Title: ORBITAL ENGINE WITH RADIAL CYLINDERS**(57) Abstract**

A radial cylinder block (2) eccentrically journaled on a shaft (15) is constrained to orbital motion within a stationary casing (1) by stabilizing eccentrics (not shown) between the cylinder block (2) and casing (1). Opposed pistons (3) within the cylinders are rigidly interconnected and eccentrically mounted on a bushing (6) rotatable about the shaft (15). The piston connecting rods (5) are slidably supported in guide bushes at the inner end of the cylinders. An arrangement of gears (7) between the bushing (6) and shaft (15) ensures that rotation of the shaft (15) and consequent orbital motion of the cylinder block (2) through its eccentrics (10) is accompanied by a counter-rotation of the bushing (6) and piston eccentrics (4) resulting in relative reciprocation of the pistons (3) within the cylinders with reduced absolute velocities of the moving parts. In particular, a two-cycle engine is disclosed with charge transfer between cylinders and having exhaust ports (14) in the cylinder walls which align periodically with matching ports (12) in the casing (1).



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ORBITAL ENGINE WITH RADIAL CYLINDERSTechnical Field

This invention relates to orbital type motors that do not function with aid of vanes, and can be operated as any type of internal combustion engine,hydraulic motor,or compressor.

Background Art

In previous constructions involving circular pistons orbiting in a cylindrical cavity,a common problem has found.

Namely;the need to adequately support the vanes that are required to divide the cavities,to seal said cavities,and to limit the peripheral speed of the moving parts.

It is the object of this invention to produce an engine fully orbital,but without any of the stated disadvantages.

Summary and best method of operation

Features of the engine are---existing cylindrical piston technology is used to provide combustion cavities,valves and timing gear are dispenced with,and the orbital speed of the moving parts are halved,relative to any given movement of the pistons,compared to previous constructions.

While the cavities can be in any configuration,it is with them set round a cylindrical housing so that. then the cylinder next in order of firing can be used to scoure and recharge the preceeding cylinder;that the engine shows to best advantage.

Since the charge is inducted and compressed inward of the pistons for transfer to the combustion cavities,it follows that two stroke operation is not only possible but desirable.

Disclosure of Invention. An Orbital reciprocating Engine

Comprising a circular housing excentrically supported round a shaft that is in turn supported centrally and rotatably in an enclosing casing, said housing able to describe an orbital path within the casing on rotation of the shaft relative to the casing.

Cylindrical cavities are journalled equally spaced round the peripheral surface of the housing to a required depth, and sections of the same radius as the housing, are made integral with the housing such as to enclose the cavities.

Pistons are slidably fitted in the cylindrical cavities, and conected by rods journalled slidably through the inward face of the cavity; to members excentrically supported on a cylindrical bush round the common shaft. rods being pinned to said members.

Said members able to orbit within the housing by reason of clearance provided within the housing.

The excentric members are set with the maximum throw oposite to the excentrics on which the cylinder housing orbits, and as a consequence, the bush on which the piston excentrics are supported will be caused to orbit in the oposite direction, gearing means are provided between the bush and the shaft to guide the piston excentrics in said oposite direction.

It will be seen that as a consequence of this contra-rotation of members, the inward and outward movements of housing and piston will converge, while the movements at right angles to the direction of reciprocation will be neutralised.

The conecting rods will there-fore be able to remain slidably supported in the housing while driving the piston.

A further advantage of contra-rotation, is that only half the throw of the excentrics is required, with a resulting saving in the

Disclosure continued

peripheral speed of the members.

While the cylinders of the engine can be in any configuration provided they are caused to orbit, the method of spacing them radially round a circular housing has the advantage of permitting each cylinder next in order, to charge the preceeding cylinder as it completes its inward stroke.

Cylinder valves slidably fitted in channels communicating the two adjoining cavities, regulate the induction and transfer of said charges from the inward side of the advance piston to the cavity outward of the preceeding piston

The valves will be drawn inward during the outward movement of the piston, uncovering a port and permitting a charge to be inducted inward of the pistons. When the inward piston stroke begins, the inducted charge is brought under pressure and said pressure drives the valve outwards sealing off the induction port and uncovering one communicating to the preceeding cavity, scouring and re-charging said cavity as it begins its outward stroke.

It will be seen that efficient two stroke operation can be readily achieved.

When used for internal combustion in Diesel operation, the fact that the cylinder housing is in orbital motion presents no problem, since injectors positioned in the cylinder housing will communicate with ports at the top of the cavities

If electrical ignition is used, contacts set in the side wall would complete a circuit to the ignition device at the correct time.

Exhaust ports in cylinder and side wall communicate as required to exhaust the cylinders, as a consequence of the orbit of the cylinder housing, said exhaust flowing to a manifold

Disclosure continued

In whatever configuration the cylinders are placed, the engine will be completely orbital, the reciprocation of the piston in the cylinders is purely relative, the piston would follow the same path, whether it was in the cylinder or not, and since the orbital members each provide only half the total stroke of the engine, they need be only half the size, allowing the stroke to be increased without exceeding the permitted limits of peripheral speed.

Sealing

Conventional proven sealing can be used between piston and cylinder walls, and circular seals between side walls and cylinder housing, are needed for exhaust and injection ports.

Cooling

The usual jacket round the cylinders, can be supplied through the stabilizing excentrics placed between housing and side wall.

Lubrication

The clearance in the housing centre provided for the piston excentrics, would serve as would a crank case.

While the engine would operate with-out the reverse gearing between cylinder housing and piston, it should be understood that the drive would then be taken by the rod where it passes through the housing.

Sufficient bearing surface would need to be provided to take the drive, and the rod given enough rigidity to prevent flexing

Ignition

Since the cylinder is in orbital motion during operation, provision is made to flow fuel to the cylinder heads where injectors in said heads are operated by cams in the outer casing

Description of drawings

Fig.(1) is a view of the engine with the side casing and adjacent excentric member⁽¹⁰⁾ removed. (1)

Shown are the circular housing⁽²⁾ in which the cylindrical cavities are journalled. Slidably fitted in the cavities are the pistons⁽³⁾ connected to the orbiting members on excentric⁽⁴⁾ by rod⁽⁵⁾ being journalled through the inner surface of the cavities.

The freely rotatable bush⁽⁶⁾ supports the excentric members which drive the piston to vary the combustion cavity⁽⁸⁾ and the induction cavity⁽⁹⁾ which are communicated by channels⁽¹⁶⁾ between adjoining cylinders.

The cylinder valve⁽¹⁸⁾ will be drawn inward during the outward movement of the piston, allowing induction to take place through channel⁽¹⁷⁾ as the piston moves inward, pressure causes the valve⁽¹⁸⁾

to move outward uncovering port⁽¹⁶⁾ and allowing a charge to flow into the cavity as the piston reaches the inward point of its travel, scouring the cavity through the ports⁽¹²⁾⁽¹⁴⁾ and recharging it.

Fig(2) Is a view of the engine through section lines A-A showing the outer casing⁽¹⁾ enclosing the cylinder housing⁽²⁾ in which the pistons⁽³⁾ reciprocate, driven by the connecting rods⁽⁵⁾ on members supported on excentrics⁽⁴⁾ from the bush⁽⁶⁾ which is supported on the common shaft⁽¹⁵⁾

The cylinder housing is caused to orbit by excentrics⁽¹⁰⁾ and is linked to the piston excentrics by reverse gearing⁽⁷⁾ driving the bush⁽⁶⁾ off shaft⁽¹⁵⁾

The combustion cavity⁽⁸⁾ receives injected fuel through ports⁽¹¹⁾ and is exhausted through port⁽¹⁴⁾ when it communicates with port⁽¹²⁾ The induction cavity⁽⁹⁾ is charged through channels⁽¹⁶⁾ (not shown) Manifold⁽¹³⁾ conducts away the spent gasses.

THE CLAIMS DEFINING THIS INVENTION ARE AS FOLLOWSClaim (1)

An engine comprising a housing supported on members excentrically supported on a shaft, to describe an orbital path with-in an outer casing in which the shaft is rotatably supported in the side walls of said casing.

Cylindrical cavities journalled to required depth in the housing, slidably accomodate pistons that are conected by rods journalled through the inner face of the cavities, to further excentrally mounted members which act to describe an orbital path with-in the housing, having clearance provided round the common shaft.

The piston members individually supported on excentric sections integral with a bush freely supported round the shaft, said members being set with the throw of the excentrics oposite to those of the cylinder housing, will accomodate to the orbital movement of the housing, by orbiting in the reverse direction.

The pistons will be caused to reciprocate with-in the cavities and the orbital movement of the housing at right angles to the direction of reciprocation, will be neutralised by the same degree of movement in the same direction by the piston and conecting rod.

Means provided to regulate the admission to and exhaust from each cavity in sequence, of a working fluid to induce orbiting of the housing and resultant rotation of the shaft.

Claim (2)

An engine as in claim (1) having the cylindrical cavities equally spaced round a circular housing, which is excentrically supported on a shaft to describe an orbital path with-in an enclosing casing on rotation of the shaft relative to the casing said shaft rotatably supported in the side walls of said casing.

Claim (2) continued

The cavities journalled to a required depth,slidably accomodate pistons that are conected by rods journalled through the inner surface of the cavities,to further excentrically mounted members supported on a bush which is itself freely supported round the common shaft within the housing.

The piston excentrics positioned on the oposite throw to those of the housing excentrics,will cause the piston and its conecting rod to orbit in the reverse direction to that of the housing,on rotation of the shaft relative to the casing,causing the piston to reciprocate in the cavities, while neutralising the orbital movement of the housing at right angles to the direction of reciprocation,by the equal movement of its own in that same direction.

The engine being operable as an internal combustion engine and including means to regulate in sequence the admission, ignition,and exhaust of a gaseous mixture relative to each cavity to induce orbiting of the housing and resultant rotation of shaft.

Claim (3)

An engine as in claims one and two,operable as a two stroke internal combustion engine,having the means to induct charges to the inward side of the pistons in each cavity,and transfer said charges to combustion cavities formed in the cylinders in the preceeding order of firing,said transfer acting to scoure and recharge them prior to their compression stroke.

Claim (4)

An engine as in claim (2)where channels provided between the cavities are bisected by a cylindrical slideway in which a valve is pressure operated to reciprocate,allowing the preceeding cavity to be charged or isolated as required,and fresh induction permitted.

Claims continuedClaim (5)

An engine as in claims (2) and (3) where fuel injectors are provided in the cylinder housing, serving to inject fuel into the head of the combustion cavity, and operated by cam tracks in the side walls.

Claim (6)

An engine as in all previous claims having reverse gearing provided between shaft and excentric piston bush, acting to guide the said bush in contra-rotation.

Clai (7)

An engine as in all previous claims, having the cylinders placed in any configuration.

AMENDED CLAIMS

[received by the International Bureau on 20 May 1986 (20.05.86);
original claims 1-7 replaced by amended claims 1-3 (1 page)]

Claim (1) An engine comprising a radial cylinder housing excentrically mounted on a shaft supported in a casing, is constrained to describe an orbital path within the casing on rotation of said shaft.

Cylindrical cavities journaled round the housing to a required depth, slidably accomodate diametrically opposed pistons that are rigidly inter-connected by rods slidably supported through the inner surface of the cavities, and excentrically round the shaft such as also to be able to describe an orbital path on rotation of the shaft.

The piston and housing excentrics being set with the respective throws at 180 degrees to each other, will cause piston and housing to follow opposite orbital paths, and resultant relative reciprocation of the piston to the cylinder, while neutralizing movement at right angles to such reciprocation.

Either piston or housing excentrics to be integral with shaft, with one freely mounted round shaft.

Means provided to regulate the admission to and exhaust from the cavities in sequence, of a working fluid or gas, to induce orbiting of piston and housing, and resultant rotation of the shaft.

Claim (2) An engine as in claim (1) operable on a two stroke and having means to induct charges inward of the pistons, for transfer between cylinders by channels provided, and combustion outward of the relative pistons.

Claim (3) Engines as in claims (1-2) having fuel injectors integral with the housing & cam operated from the casing; to provide fuel to the combustion cavities

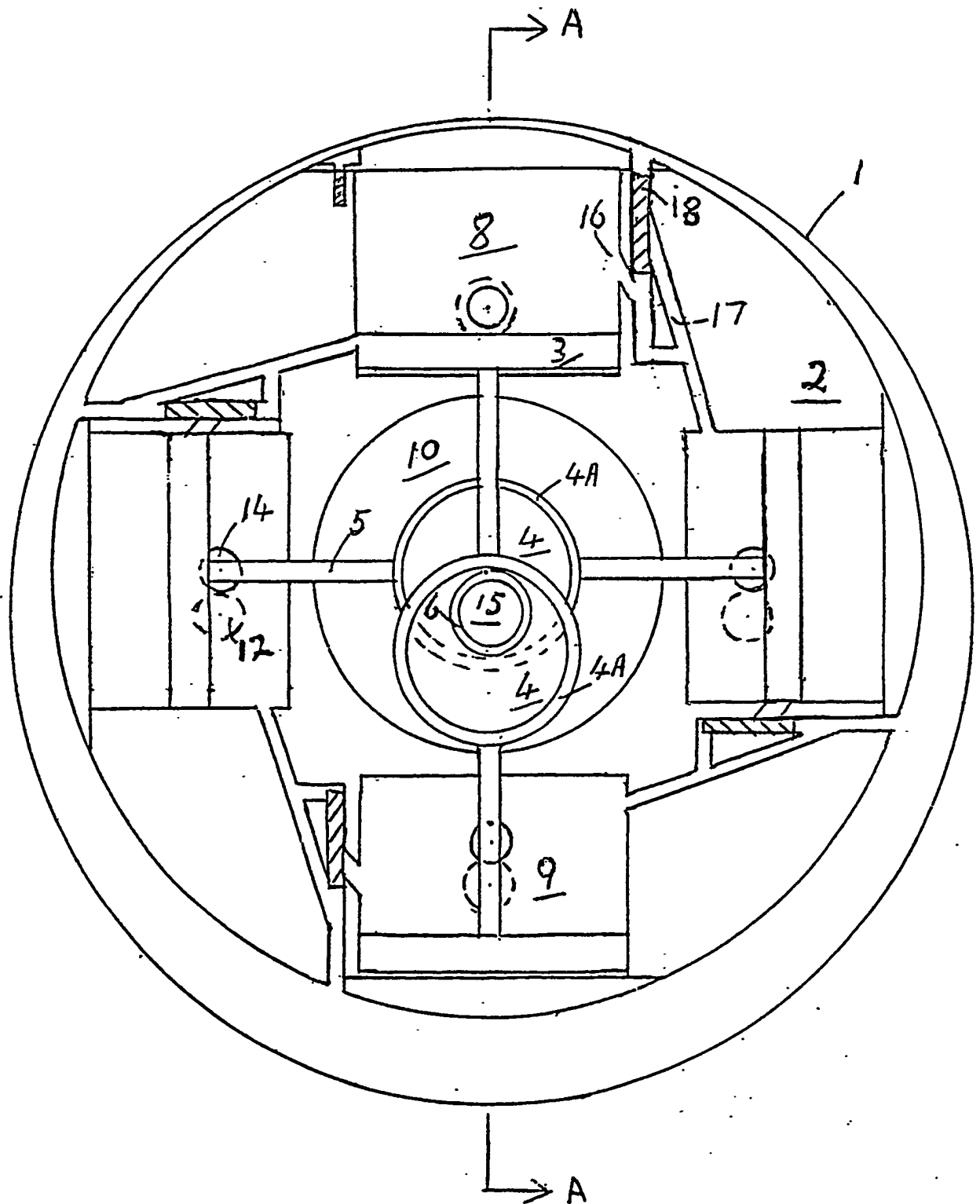
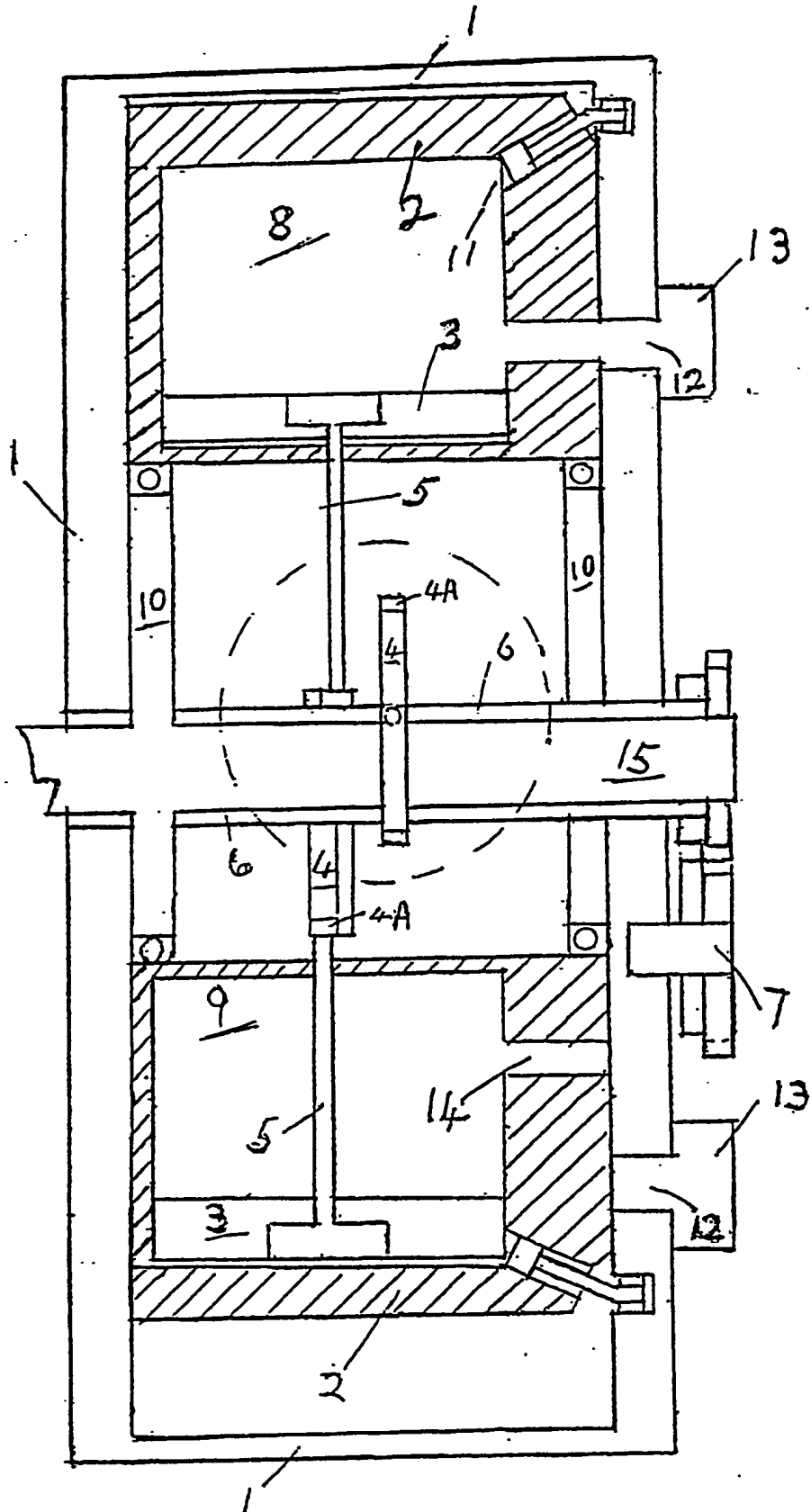
FIG (1)

FIG (2)

SECTION A-A

INTERNATIONAL SEARCH REPORT

International Application No

PCT/AU 85/00275

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl.⁴ F02B 75/22, 75/32, 57/06, 57/08, F01B 1/06, 9/04

II. FIELDS SEARCHED

Minimum Documentation Searched⁷

Classification System

Classification Symbols

IPC F02B 75/22, 75/32, 57/06, 57/08, F01B 1/06, 9/04

Documentation Searched other than Minimum Documentation
to the extent that such Documents are included in the Fields Searched⁸

AU : IPC as above; Australian Classification 64.8, 66.212x

III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹

Category ¹⁰	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No ¹³
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- | | | |
|---|---|--|
| A | AU,B, 3583/21 (KAYE ENGINE COMPANY PROPRIETARY LIMITED)
26 September 1922 (26.09.22) | |
| A | US,A, 3258992 (HITTELL) 5 July 1966 (05.07.66) | |
| A | US,A, 3517651 (GRAYBILL) 30 June 1970 (30.06.70) | |
| A | AU,B, 64760/74 (466936) (COLLINS) 2 May 1974
(02.05.74) | |
| A | US,A, 3946706 (PAILLER) 30 March 1976 (30.03.76) | |
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(10.03.77) | |
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(20.04.39) | |
| A | US,A, 4331108 (COLLINS) 25 May 1982 (25.05.82) | |

* Special categories of cited documents: ¹⁰

"A" document defining the general state of the art which is not considered to be of particular relevance

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"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"A" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search

5 March 1986 (05.03.86)

International Searching Authority

Date of Mailing of this International Search Report

27 March 1986 (27.3.1986)

Signature of Authorised Officer

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON
INTERNATIONAL APPLICATION NO. PCT/AU 85/00275

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document
Cited in Search
Report

Patent Family Members

US 3946706

DE 2427355

FR 2233868

AU 36879/78

JP 55019982

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AU 59809/80

EP 23622

US 4331108

AU 30532/77
GB 1548790

DE 2751675
HK 595/80

FR 2371577
JP 53081805

END OF ANNEX

DERWENT-ACC-NO: 1987-150652

DERWENT-WEEK: 198721

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TITLE: Orbital IC engine with radial cylinders - has
radial cylinder block
mounted eccentrically on shaft with bores to receive
pistons

INVENTOR: RUSSELL, S H

PATENT-ASSIGNEE: RUSSELL S H[RUSSEI]

PRIORITY-DATA: 1985WO-AU00275 (November 12,
1985) , 1986AU-0059428 (May 27,
1986) , 1985EP-0905734 (November 12, 1985)

PATENT-FAMILY:

PUB-NO	PUB-DATE	LANGUAGE	
PAGES	MAIN-IPC		
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N/A			
AU 8651984 A	June 2, 1987	N/A	
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000 N/A
EP 245245 A November 19, 1987 E
000 N/A
GB 2195705 A April 13, 1988 N/A
000 N/A

DESIGNATED-STATES: AU JP US AT BE CH DE FR GB
IT LU NL SE AT BE CH DE FR GB IT L
I LU NL SE

CITED-DOCUMENTS: AU 2103583; AU 3802225 ; AU
7464760 ; AU 7615896 ; AU 7836879
; US 3258992 ; US 3517651 ; US 3946706 ; WO
8002584 ; WO 8002584

APPLICATION-DATA:

PUB-NO	APPL-DESCRIPTOR	APPL-NO
WO 8703042A	N/A	
1985WO-AU00275	November 12, 1985	
AU 8659428A	N/A	1986AU-0059428
May 27, 1986		
EP 245245A	N/A	1985EP-0905734
November 12, 1985		
GB 2195705A	N/A	1986GB-0014559
June 16, 1986		

INT-CL_(IPC): F01B001/06; F01B009/04 ;
F02B057/06 ; F02B075/22

ABSTRACTED-PUB-NO: WO 8703042A

BASIC-ABSTRACT: The engine has a radial cylinder housing eccentrically mounted on a shaft supported in a casing (1). Cylinders are journalled for movement around the housing to slidably accommodate pistons (3) that are rigidly connected by rod (5).

The piston and housing eccentrics are set with resp. throws at 180 degrees to each other. This causes the piston and housing to follow opposite orbital paths, for resultant relative reciprocation of each piston and cylinder.
Either the piston or housing eccentrics are integral with the shaft (15).

ADVANTAGE - Improved sealing and support of divider vanes.

CHOSEN-DRAWING: Dwg.2/2

TITLE-TERMS:

ORBIT IC ENGINE RADIAL CYLINDER RADIAL
CYLINDER BLOCK MOUNT ECCENTRIC SHAFT
BORE RECEIVE PISTON

DERWENT-CLASS: Q51 Q52

SECONDARY-ACC-NO:

Non-CPI Secondary Accession Numbers: N1987-112901